J. Watson

NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

FOR RELEASE: WEDNESDAY P.M.
April 7, 1971

RELEASE NO: 71-58

HEART DISEASE DIAGNOSTIC TOOL

Doctors can watch a movie of the beating of a patient's diseased heart--identifying dead spots or scar tissue in the heart wall, aneurysms (bubble-like projections of the heart muscle), and other malfunctions--with a computer method devised by a National Aeronautics and Space Administration-Stanford University team.

The system, which is still under development, would improve on current complex diagnostic methods by providing a simple means of viewing the heart in action. Figuratively, it allows doctors to "walk around" the isolated beating heart, viewing it from any desired angle. They also can stop the display at any desired point of heart expansion or contraction and can play the picture back and forth for many cycles.

The system projects a three-dimensional animated cartoon-like image of any desired chamber of the patient's heart, in lines of light on a computer display screen, similar to a television screen. The display is derived from two-dimensional "X-ray movies" made by injecting X-ray contrast dye into the desired heart chamber.

Scientists and doctors from NASA-Ames Research Center, Mountain View, CA, and the Cardiology Division of Stanford University Medical Center, Palo Alto, CA, have worked together on the system.

It appears that the method may be a major advance for the physician to determine the patient's need for heart surgery, coronary artery grafts, and treatment of various heart conditions. Heart disease is the leading cause of death in the United States.

The system's animated display is exact enough to show dead sections of the heart wall about the size of a nickel (two centimeters) details of large malfunctions, and holes between heart chambers. Combined with standard clinical measurements of blood-flow per heart beat, it can measure inefficient pumping by heart chambers. It will also help to identify leaky valves and shows the severity of valve damage.

This system will allow further validation of a sonar-like system for testing heart function which is also under development by this group of scientists. These sonar systems would allow examination of the healthy hearts of astronauts, pilots and ordinary citizens, using a simple sensor placed on the chest.

"The Ames animated display system seems to be an important advance in the diagnostic tools for studying heart disease," said Dr. Donald C. Harrison, chief of the Division of Medical Cardiology at Stanford Medical Center, which is doing the clinical work on the project.

"While X-ray examinations of hearts as they beat are currently in use," said Ames' Dr. Harold Sandler, originator of the system, "X-rays are two-dimensional and hard to interpret because of the various other body structures in the same picture."

The value of the method for doctors is that it eliminates all irrelevant details. For example, it can show the complete interior surface of the beating left ventricle (the heart's main pump) on the lighted display screen and nothing else. The system can do the same with the right ventricle and the two auricles (intake pumps).

Since the animated displays are a form of computer readout, they can be transmitted to doctors at distant locations by an ordinary telephone line, and recreated on a computer display screen.

The displays are derived from X-ray movies, plus a computer program based on intensive research in heart configurations and dimensions, plus new three-dimensional computer display techniques. Daryl Rasmussen, Ames Research engineer, developed the mathematical and computer techniques, using data gathered by Dr. Sandler during six years of work at Ames on heart chamber dimensions and means of measuring them.

Doctors first take the X-ray movie, known as an angiogram. To do this, they inject a dye opaque to X-rays through a catheter into the patient's heart. The X-rays then outline the selected heart chamber in cross section as it expands and contracts.

Stanford cardiologists working under Dr. Harrison's direction take two sets of X-ray movies at right angles to each other, at 60 frames (pictures) per second.

Obtaining the X-rays may be difficult since injection of the angiographic dye itself changes the function of the heart and makes only the data from two heart beats acceptable for analysis. However, the researchers use a variety of independent measurements to make sure the two beats used are exactly typical. Validation of the technique by other independent means is now being accomplished.

From the two X-ray movies, the computer constructs the animated display. The entire sequence of movie frames, each one containing the heart chamber outline, is traced on a computer input screen, and is retained in the computer memory. The computer program then mathematically projects the two views of the heart chamber back into space. From these it reconstructs the chamber. This three-dimensional construction is also stored in the computer memory for analysis and display.

The technique allows the computer to calculate the changing positions of the entire interior surface of the heart chamber in question, so the moving heart chamber can be seen from any point.

The computer program is based on studies of the exact proportions of hundreds of normal and abnormal human hearts gathered by Dr. Sandler from autopsies, and studies of patients with heart diseases of various types.

The two stored beats are repeated over and over by the computer, allowing doctors to study the heart in action for any desired period of time.

-end-